**Class: XII Session: 2020-2021**

**Subject: Physics**

**Sample Question Paper (Theory)**

Maximum Marks: 70 Marks Time Allowed: 3 hours

***General Instructions:***

1. All questions are compulsory. There are 33 questions in all.

2. This question paper has five sections: Section A, Section B, Section C, Section D and Section E.

3. Section A contains ten very short answer questions and four assertion reasoning MCQs of 1 mark each, Section B has two case based questions of 4 marks each, Section C contains nine short answer questions of 2 marks each, Section D contains five short answer questions of 3 marks each and Section E contains three long answer questions of 5 marks each.

4. There is no overall choice. However internal choice is provided. You have to attempt only one of the choices in such questions.

5. You may use the following values of physical constants where ever necessary.

$c = 3 \times 10^{8}$ m/s

$h = 6.63 \times 10^{-34}$ Js

$e = 1.6 \times 10^{-19}$ C

$\mu_o = 4\pi \times 10^{-7}$ TmA$^{-1}$

$\varepsilon_o = 8.854 \times 10^{-12}$ C$^2$N$^{-1}$m$^{-2}$

$\frac{1}{4\pi\varepsilon_o} = 9 \times 10^{9}$ Nm$^2$C$^{-2}$

$m_e = 9.1 \times 10^{-31}$ kg

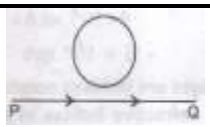
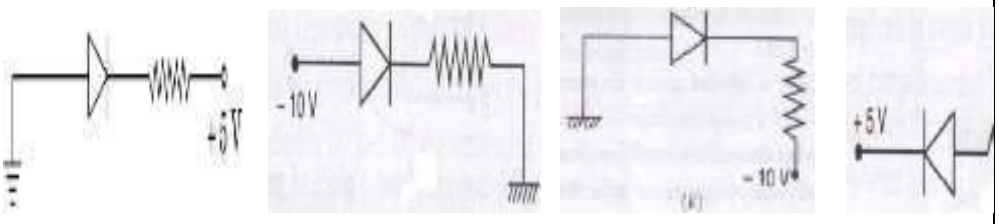
mass of neutron $= 1.675 \times 10^{-27}$ kg

mass of proton $= 1.673 \times 10^{-27}$ kg

Avogadro's number $= 6.023 \times 10^{23}$ per gram mole

Boltzmann constant $= 1.38 \times 10^{-23}$ JK$^{-1}$

| S. No. | ***Section –A***<br><br>**All questions are compulsory. In case of internal choices, attempt any one of them.** | Marks |
|---|---|---|
| 1 | Write the expression, in vector form,for the Lorentz magnetic force due to a charge moving with some velocity in a magnetic field . What is the direction of the magnetic force?<br><br>OR<br><br>Two parallel current carrying conductors of infinite length are placed in free space at certain distance apart. How can you define current of one ampere in this case ? | 1 |
| 2 | Write the relationship for the speed of electromagnetic waves in terms of amplitudes of electric and magnetic fields.<br><br>OR<br><br>Write any one use of em-wave produced in nuclear reactions and also emitted by radioactive nuclei. | 1 |
| 3 | Name the physical quantity whose S.I.unit is $TA^{-1}$ m.<br><br>OR<br><br>Horizontal and vertical components of earth's magnetic field are equal. What is the angle of dip at that place ? | 1 |

| | | |
|---|---|---|
| 4 | A conducting loop is held above a current carrying wire as shown in the figure. Depict the direction of the current induced in the loop when the current in the wire is constantly increasing.   | 1 |
| 5 | A light ray travelling in air enters glass of refractive index 1.5. Estimate the velocity of light in glass. | 1 |
| 6 | In a photoelectric experiment, the potential required to stop the ejection of electrons from cathode is 1.5V. What is the value of maximum kinetic energy of emitted Photoelectrons? | 1 |
| 7 | Express one joule in eV. Taking 1a.m.u.=931MeV,calculate the mass of C-12 atom.<br>OR<br>What do you mean by the term 'Mass-Defect' ? | 1 |
| 8 | In the following circuit diagram, is the junction diode forward biased or reverse biased ?<br>   | 1 |
| 9 | Which type of biasing gives a semiconductor diode very high resistance ? | 1 |

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|---|---|---|
| 10 | Draw the graph of V & I for a p-n junction diode in forward biasing. | 1 |

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| # | **For question numbers 11, 12, 13 and 14, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.**<br>**a) Both A and R are true and R is the correct explanation of A.**<br>**b) Both A and R are true but R is NOT the correct explanation of A.**<br>**c) A is true but R is false**<br>**d) A is false and R is also false.** | |
| 11 | **Assertion(A) : The direction of electric field due to an electric dipole at a point on its axial line is opposite to that of its electric dipole moment.**<br><br>**Reason(R): The direction of electric field due to an electric dipole at a point on its equatorial line is same as that of its electric dipole moment.** | 1 |
| 12 | **Assertion(A): In uniform electric field,the net force acting on an electric dipole is zero.**<br><br>**Reason(R): In uniform electric field, the net torque acting on an electric dipole is zero.** | 1 |
| 13 | **Assertion (A): The brilliance of diamond is due to Total Internal Reflection of light rays entering in it.**<br><br>**Reason (R): When a ray of light travelling in denser medium,gets incident on the interface at an angle greater than the critical angle ,it gets reflected back into the same medium.** | 1 |
| 14 | **Assertion(A): When a telescope is in normal adjustment, the distance between the object lens and the eye lens is equal to the sum of their focal lengths.**<br><br>**Reason (R): In a compound microscope, object lens is of short focal length and of short aperture, while eye lens has short focal length and large aperture.** | 1 |
| # | ***Section – B***<br><br>**Questions 15 and 16 are Case Study based questions and are compulsory. Attempt any 4 sub parts from each question. Each question carries 1 mark.** | |

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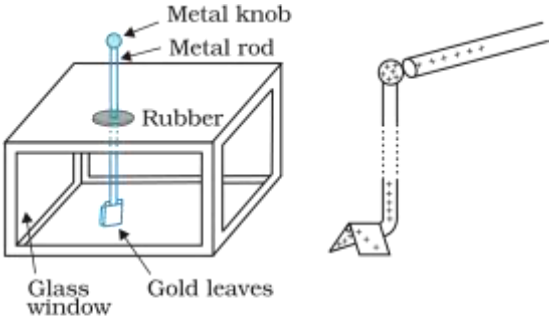
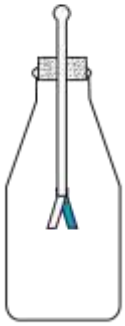
| 15 | **A simple apparatus to detect charge on a body is the *gold-leaf electroscope* as shown in figure below. It consists of a vertical metal rod housed in a box, with two thin gold leaves attached to its bottom end. When a charged object touches the metal knob at the top of the rod, charge flows on to the leaves and they diverge. The degree of divergance is an indicator of the amount of charge.**<br>  <br><br>(a)<br>  <br>(b)<br>**1. What kind of charges can be detected with the help of an electroscope?**<br>**a) Only charges at rest.**<br>**b) Only charges in motion.**<br>**c) Both of the above.**<br>**d) None of the above.**<br>**2. A neutral object can be made charged by:**<br>**a) Adding electrons to it.**<br>**b) Removing electrons from it.**<br>**c) Both a & b .**<br>**d) None of these.**<br>**3. An object can be actually charged positively by:**<br>**a) losing some of its electrons.**<br>**b) gaining some of extra electrons.**<br>**c) keeping its no.of protons & electrons equal.**<br>**d) giving positive charge to it.** | **4** |

| | | |
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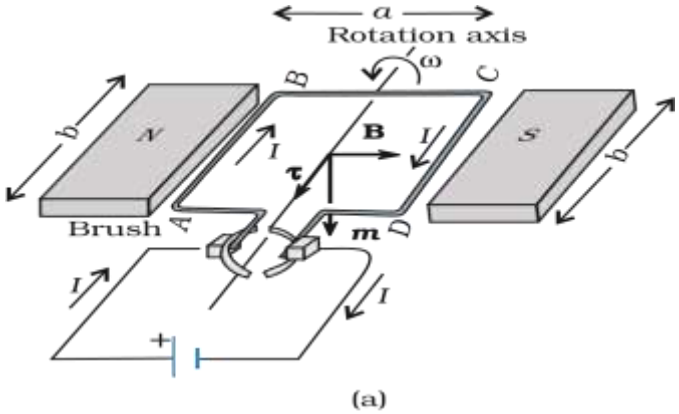
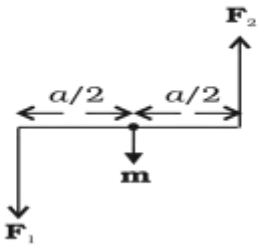
| | **4. An object can be actually charged negatively by:**<br>**a) losing some of its electrons.**<br>**b) gaining some of extra electrons.**<br>**c) Keeping its no.of protons & electrons equal.**<br>**d) None of the above.** | |
| | **5. The extent of separation of leaves of the gold leaf electroscope gives a rough idea of:**<br>**a) Positive charge,**<br>**b) Negative charge,**<br>**c) Amount of charge present on the object,**<br>**d) None of the above** | |
| 16 |  <br>(a)<br>  <br>(b) | 4 |

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| | **A rectangular loop ABCD carrying a steady current I is placed in a uniform magnetic field as shown in figure above. The field exerts no force on the two arms AD and BC of the loop. It is perpendicular to the arm AB and CD of the loop and hence exerts some force on them, which is just equal in magnitude and opposite in direction. Thus the net force on the loop becomes zero.**<br><br>**1. Which rule will you apply to determine the direction of force acting on various sides of the rectangular loop?**<br>**a) Fleming's Left Hand Rule.**<br>**b) Fleming's Right Hand Rule.**<br>**c) Ampere's Swimming Rule,**<br>**d) Maxwell's Cork-Screw Rule.**<br><br>**2. The direction of magnetic field in this case us:**<br>**a) From left to right.**<br>**b) From right to left.**<br>**c) Perpendicularly inward to the plane of loop,**<br>**d) Perpendicularly outward to the plane of loop.**<br><br>**3. The angle between normal to the plane of this loop and the magnetic field after half rotation from this position will be:**<br>**a) 90°**<br>**b) 180°**<br>**c) 0°**<br>**d) None of these.**<br><br>**4. The above assembly represents the working principle of:**<br>**a) A.C. Generator,**<br>**b) Transformer,**<br>**c) Moving Coil Galvanometer,**<br>**d) None of the above.**<br><br>**5. The net torque acting on the loop mainly depends upon:**<br>**a) No.of turns of the coil,**<br>**b) Strength of magnetic field,**<br>**c) Area of the coil,**<br>**d) All of the above.** | |
| # | **Section – C**<br>**All questions are compulsory. In case of internal choices, attempt anyone.** | |

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| 17 | A moving coil galvanometer of resistance of 10 Ω produces full scale deflection, when a current of 25mA is passed through it. Describe showing full scale deflection, how will you convert the galvanometer into a) a voltmeter reading upto 120 V, b) an ammeter reading upto 20 A ? | 2 |
| 18 | Draw a ray diagram to show how a right angled isosceles prism can be used to a) deviate a light ray through 90°, b) deviate a light ray through 180° ? | 2 |
| 19 | Two point charges $q_A$ =3μC and $q_B$ =-3**μ**C are located 20 cm apart in vacuum.<br>a) What is the electric field at the mid point O of the line AB joining the two charges ?<br>b) If a negative test charge of magnitude $1.5\times10^{-9}$ C is placed at this point, what will be the force experienced by this charge ?<br><br>OR<br><br>What do you mean by an electric dipole and electric dipole moment ? Derive an expression for electric field intensity on the equatorial line of an electric dipole. | 2 |
| 20 | What is a photodiode ? Describe the working of a photodiode by drawing a suitable circuit-diagram. Also draw the characteristics of a photodiode for different illumination intensities. | 2 |
| 21 | Explain with the help of a suitable example how we can show that Lenz's Law is a consequence of the Principle of ***Conservation Of Energy.***<br><br>OR<br><br>A rectangular loop and a circular loop are moving out of a uniform magnetic field region to a field free region with a constant velocity **v.** The field is normal to both the loops. In which loop do you expect the induced emf to be constant during the passage out of the field region? Give strong reason to support your answer. | 2 |
| 22 | Two thin convex lenses $L_1$ and $L_2$ are placed coaxially in contact. An object is placed at a point beyond the focus of the lens. Draw the ray diagram to show the image formation and hence, derive the expression for the focal length of this combination. | 2 |

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| 23 | Draw the circuit diagram for studying the V-I characteristics of a p-n junction diode in a) forward biasing, b) reverse biasing. Also draw the typical V-I characteristics of a silicon diode. | 2 |
| 24 | Calculate the torque acting on a 100 turn rectangular coil of length 40 cm and breadth 20 cm, carrying a current of 10 A, when placed making an angle of 60° with a uniform magnetic field of 5 T. | 2 |
| 25 | Derive Snell's law on the basis of Huygen's Wave Theory, when light is travelling from rarer to denser **medium/denser** to rarer medium.<br><br>OR<br><br>State the conditions, which must be satisfied for two light sources to be coherent. | 2 |
| # | ***Section -D***<br><br>**All questions are compulsory. In case of internal choices, attempt any one.** | |
| 26 | Use the expression for Lorentz force acting on the charge carriers of a conductor to obtain the expression for the induced emf across the length L moving with velocity **v** through a magnetic field **B** acting perpendicular to its length. | 3 |
| 27 | (i) Compare the resistance of two wires of same material. Their lengths are in ratio 2:3 and their diameters are in the ratio 1:2.<br><br>(ii) The potential difference across a given copper wire is increased. What happens to the drift velocity of the charge carriers ?<br><br>OR<br><br>(i) In a potentiometer arrangement, a cell of emf 1.25 V gives a balance point at 35.0 cm length of the wire. If the cell is replaced by another cell and the balance point shifts to 63.0 cm, what is the emf of the second cell?<br>(ii) Why thick copper wires are used in a slide wire bridge ? | 2<br><br>1 |

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| 28 | If the frequency of incident radiation on the cathode of a photocell is doubled, how will the following change:<br>a) kinetic energy of the electrons ?<br>b) photoelectric current ?<br>c) stopping potential ?<br>OR<br>(i) Calculate the momentum of electrons, if their wavelength is 2 A°.<br>(ii) How are energy and momentum of a photon related to each other? | 3<br><br><br><br><br>2<br>1 |
| 29 | (i) Define the term ***'Mass-Defect' .***<br>(ii) Is the probability of backward scattering (i.e. scattering of alpha particles at angles greater than 90°) predicted by Thomson's Model much less, about the same or much greater than that predicted by Rutherford's Model of atom ? Justify your answer. | 1<br><br>2 |
| 30 | (i) Differentiate between nuclear fission and nuclear fusion reactions.<br>(ii) What are nuclear reactions ? State the laws governing these reactions. Give one example of nuclear reaction. | 2<br><br>1 |
| # | **Section – E**<br>**All questions are compulsory. In case of internal choices, attempt any one.** | |
| 31 | (i) What are the equipotential surfaces ? Mention any three properties of equipotential surfaces.<br>(ii) Draw the equipotential surfaces for:<br>a) An isolated point charge.<br>b) Uniform Electric Field.<br>c) An Electric Dipole.<br>(iii) How can you prove the Electric Field as a negative gradient of Electric Potential?<br>OR<br>(i) State Gauss's Theorem with the help of proper relevant diagram. | 2<br><br>1<br><br>2 |

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| | (ii) | How can we use Gauss's theorem to determine the Electric field due to two thin infinite plane parallel sheets of charge ? | |
| | (iii) | Show that the Electric field is independent of the distance between the infinite plane sheets of charge, if the two sheets have equal and opposite surface charge densities. | |
| 32 | (i) | Derive an expression for path difference in Young's Double Slit Experiment. Also obtain the conditions for constructive and destructive interference at a point on the screen. | 2 |
| | (ii) | Hence deduce an expression for fringe width. | 2 |
| | (iii) | Also draw the graph showing the variation of intensity with Interference Pattern. | 1 |
| | | OR | |
| | (i) | Draw a labelled diagram to show the image formation by an astronomical telescope in normal adjustment. | 2 |
| | (ii) | Define the magnifying power of an astronomical telescope for normal adjustment and hence derive an expression for it. | 2 |
| | (iii) | Compare a reflecting type telescope with a refracting type telescope. | 1 |
| 33 | (i) | Explain with the help of a labelled diagram, the principle and working of an A.C. Generator. | 2 |
| | (ii) | Hence obtain the expression for the emf generated in the coil. | 1 |
| | (iii) | Draw the schematic diagram showing the nature of alternating emf generated by the rotating coil in the magnetic field during one cycle. | 2 |
| | | OR | |
| | (i) | Draw the schematic diagram of step up/ down Transformer explaining its working principle. | 2 |
| | (ii) | Deduce an expression for secondary to primary voltage in terms of no.of turns in the coil. | 2<br>1 |

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| | (iii) In an ideal Transformer, how is this ratio related to the currents in the two coils ? | |
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## Class –XII

## PHYSICS (Theory)

## SQP Marking Scheme 2020-21

| Sr. No. | **VALUE POINTS** | Marks |
|---|---|---|
| 1 | **F=**q(**v×B),** The direction of **F** will be perpendicular to both **v** & **B.** | 1 |
| 2 | Speed=Ratio of amplitudes of Electric & Magnetic field vectors.<br>OR<br>Any one use of gamma rays | 1 |
| 3 | Permeability of a medium<br>OR | 1 |

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| | Angle of dip=45° | |
| 4 | Clockwise | 1 |
| 5 | $2\times10^{8}$ m/s | 1 |
| 6 | 1.5eV | 1 |
| 7 | 1 J=$6.25\times10^{18}$ eV, mass of C-12 atom:$1.986\times10^{-26}$ kg | 1 |
| 8 | Iii and iv | 1 |
| 9 | Reverse biasing | 1 |
| 10 | Correct diagram | 1 |
| 11 | d)A is false and R is false | 1 |
| 12 | c) A is true but R is false | 1 |
| 13 | a) Both A and R are true and R is the correct explanation of A | 1 |
| 14 | b)Both A and R are true and R is NOT thecorrect explanation of A | |
| 15 | i)a, ii)c, iii)a, iv)b, v)c | |
| 16 | i)a, ii)a, iii)a, iv)c, v)d | |
| 17 | a)A large resistance R=4790 **Ω** has to be connected in series with it.<br><br>b)A small resistance S=0.0125 **Ω** has to be connected in parallel with it. | |
| 18 | Correct diagram of T.I.R. in a right angled isosceles prism i) through 90°, ii) through 180° | |

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| 19 | i)$E=5.4\times10^{6}$ N/C<br><br>ii)$F= -8.1\times10^{-3}$ N (along OA). | |
| 20 | Correct definition, diagram and graph. | |
| 21 | Correct Explanation for law of conservation of energy.<br><br>OR<br><br>Rectangular loop. It is because in case of circular loop the rate of change of area of the loop during the passage out of the field region is not constant, hence induced emf will vary accordingly. | |
| 22 | Correct derivation and diagram of focal length of combination of thin lenses. | |
| 23 | Correct circuit diagram and graph | |
| 24 | Torque=200Nm | |
| 25 | i)Correct deduction of Law of refraction from Huygen's Principle.<br><br>ii)Conditions for coherent sources. | |
| 26 | Correct derivation of motional emf using Lorentz's Force. | |
| 27 | i) R1:R2 = 8:3<br><br>ii) Drift velocity will increase.<br><br>OR<br><br>i) E2 = 2.25V<br><br>ii) In case, copper wire are not thick, then their resistances have to be included in respective ratio arms. | |
| 28 | i) K.E. will increase.<br><br>ii) No effect on Photoelectric current<br><br>iii) Stopping Potential will increase | |

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| | OR<br>i) Momentum p=3.313× $10^{-24}$ kg m/s.<br>ii) P=E/c | |
| 29 | i) Correct definition of mass defect<br>ii) Thomson's Model predicts the backward scattering of alpha particles much less than predicted by Rutherford's Model. The reason is in Thomson's Model, positive charge is uniformly distributed over whole of the nucleus instead of being concentrated in a small part. | |
| 30 | i) Any two differences between nuclear fusion and nuclear fission.<br>ii) Correct definition. Governing laws: Law of conservation of mass, charge no.,spin quantum no. | |
| 31 | i) Correct definition, any three properties of equipotential surfaces.<br>ii) Correct diagrams<br>iii) Correct derivation of E=negative gradient of Potential.<br>OR<br>i) Correct statement.<br>ii) Correct derivation<br>iii) Correct explaination | |
| 32 | Correct derivations, definitions, graphs and diagrams | |
| 33 | Correct diagrams and derivations | |